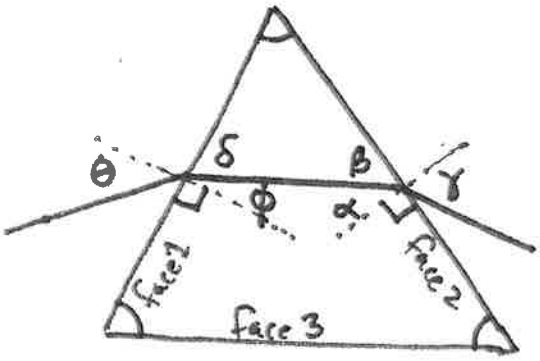
ASG vol 3 Ex 12.5 (Total internal reflection)



- We know $\frac{\sin\theta}{\sin\phi} = \frac{3}{2}$

or $\frac{\sin\alpha}{\sin\gamma} = \frac{2}{3}$

- For total internal reflection, $\gamma = 90^\circ$ or $\sin\gamma = 1$
- Thus $\sin\alpha = \frac{2}{3}$

- What is the relationship between ϕ and α? $\phi + \delta = 90$.

Also $\delta + \beta + 60 = 180$. And $\alpha + \beta = 90$. Thus

$$\phi = 90 - \delta = 90 - (180 - 60 - \beta) = \beta - 30 = (90 - \alpha) - 30 \quad \text{or}$$

$$\phi = 60 - \alpha$$

- So $\sin\theta = \frac{3}{2}\sin(60-\alpha) = \frac{3}{2}\sin\left(60 - \arcsin\left(\frac{2}{3}\right)\right) = 0.468$

or $\boxed{\theta = 27.9^\circ}$ Any smaller angle will lead to total internal reflection. The totally internally reflect beam will emerge from the third face because the incidence angle on this face is quite small.